
Review Article

***Solanum xanthocarpum* Chemical Constituents and Medicinal Properties: A Review**

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Abstract: India with its knowledge of rich ancient traditional systems of medicine provides a strong base for the utilization of a large number of plants in general healthcare. Large number of herbal drugs existing in India, very few has been studied systematically so far. *Solanum xanthocarpum* is an important medicinal herb in Ayurvedic medicine. Various studies indicated that *Solanum xanthocarpum* possesses antiasthmatic, hypoglycemic, hepatoprotective, antibacterial and insect repellent properties. The present review aims to document the medicinal properties of *Solanum xanthocarpum* and its potential prospects for the further scientific investigation for the development of effective therapeutic compounds.

Keywords: Medicinal plants, *Solanum xanthocarpum*, pharmacology, Herbal drugs

INTRODUCTION

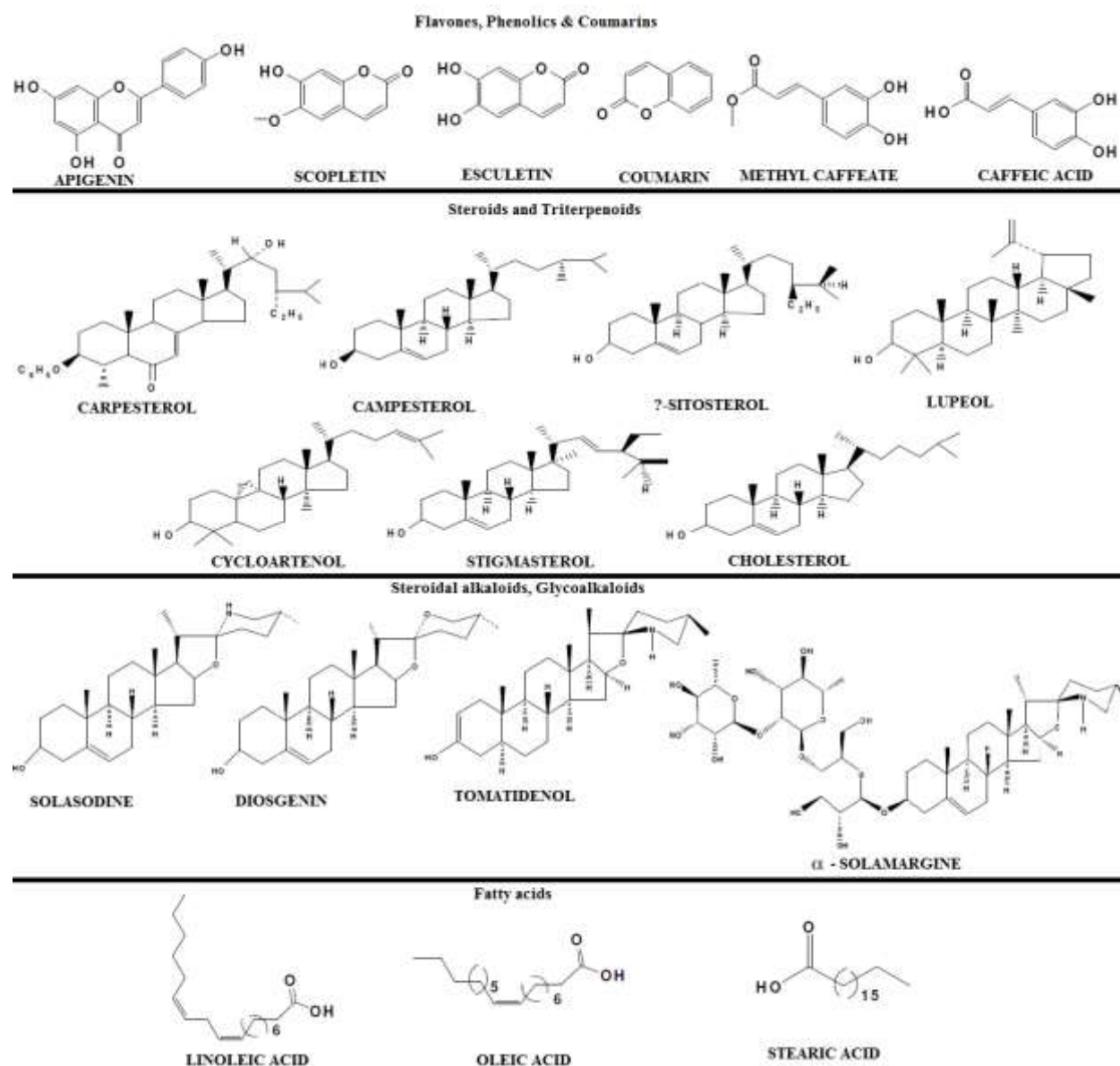
India with its mega-biodiversity and knowledge of rich ancient traditional systems of medicine (Ayurveda, Siddha, Unani, Amchi and local health traditions) provide a strong base for the utilization of a large number of plants in general healthcare and alleviation of common ailments of the people [1]. *Solanum xanthocarpum* is commonly known as the Indian night shade or Yellow berried night shade (English). It is a prickly diffuse, bright green perennial herb, woody at the base, 2–3 m height, found throughout India, mostly in dry places as a weed along roadsides and waste lands. *Solanum xanthocarpum* is known by different name in various different languages in India viz, Kantkari (Sanskrit), Kateri (Hindi), Bhoringni (Gujarati), Kantankattiri (Tamil), Kantkaricunta (Malayalam), Vakudu (Telugu), Nelagulle (Kannad) [2]. In ancient Ayurveda, plant is described as pungent, bitter, digestive, alternative astringent. Stems, flowers, fruits are bitter, carminative. Root decoction used as febrifuge, effective diuretic and expectorant. Charaka and Sushruta used the extract of entire plant and fruits in internal prescription for bronchial asthma, tympanitis, misperistalsis, piles and dysuria and for

rejuvenation. *Kantkari Ghrita* of *Charaka* is specific for cough and asthma. The whole plant is used traditionally for curing various ailments. Decoction of the plant is used in gonorrhea; paste of leaves is applied to relieve pains; seeds act as expectorant in cough and asthma; roots are expectorant and diuretic, useful in the treatment of catarrhal fever, coughs, asthma and chest pain [3].

Solanum xanthocarpum is a well known medicinal plant in traditional medicinal system and recent scientific studies have emphasized the possible use of *Solanum xanthocarpum* in modern medicine. The present review aims to document the medicinal properties of *Solanum xanthocarpum* and its potential prospects for the further scientific investigation for the development of effective therapeutic compounds.

Chemical Constituents

Solanum xanthocarpum plant contains alkaloids, sterols, saponins, flavonoids and their glycosides and also carbohydrates, fatty acids, amino acids etc. Structures of some phytoactive compounds from *Solanum xanthocarpum* are illustrate in figure 1.

Fig. 1: Some phytoactive compounds from *Solanum xanthocarpum*.

MEDICINAL PROPERTIES OF *Solanum xanthocarpum*

Solanum xanthocarpum is an important medicinal plant and in recent history this plant is reported for various medicinal properties.

Anti-Fertility activity

Solasodine, an alkaloid of *Solanum xanthocarpum* possesses antispermatic activity [4]. In Dixit VP 1980 study, chronic administration of solasodine (20mg/kg each other day oral for 60 days) rendered male rats and dogs infertile. Mating test showed 87% infertility in rats, this returned to normal after 60 days cessation of drug feeding. Solasodine is well tolerated and inhibits spermatogenesis and Sperm motility. No significant change was noticed in the weight of testes and accessory sex organs. The RNA, protein, sialic acid

and glycogen contents of the test were reduced significantly, serum proteins, triglycerides, Serum enzymes (GOT/GPT /Alkaline phosphatase) nonesterified fatty acids levels were in normal range. Solasodine is estrogen free but inhibits testosterone release from dispersed mouse Leydig cells (200 uM significantly inhibited unstimulated and LH stimulated release). Solasodine can be developed as male pill of plant origin [5].

Antihyperlipidemic activity

The Antihyperglycemic activity was associated with increase in plasma insulin. Though the exact mechanism of action is not known, it could be due to increased pancreatic secretion of insulin from existing β -cells. It is known that certain alkaloids and flavonoids present in *Solanum xanthocarpum* exhibit

hypoglycemic activity and is also known for their ability of beta cell regeneration of pancreas [6].

Hepatoprotective activity

In Chandana VR *et al.* investigation, *Solanum xanthocarpum* extracts was evaluated for hepatoprotective activity using CCl₄ induced hepatotoxicity in rats. The hepatotoxicity induced by CCl₄ is due its metabolites CCl₃. Rats administered with CCl₄ but treated with *Solanum xanthocarpum* extracts showed significant increased in the level of enzyme which indicates the antioxidant activity of *Solanum xanthocarpum*. Jigrine is a polypharmaceutical herbal formulation containing aqueous extracts of 14 medicinal plants including *Solanum xanthocarpum* and used for liver ailments [7]. A K Najmi *et al.* investigated the DPPH-free radical scavenging activity, hepatoprotective and antioxidant activity of Jigrine against galactosamine induced hepatotoxicity in rats [8].

Apoptosis Inducing activity

Lupeol, apigenin and solamargine from *Solanum xanthocarpum* exhibited anticancer property. Appearance in solamargine-treated cells of chromatin condensation, DNA fragmentation, and a sub-G1 peak in a DNA histogram suggested that solamargine induced cell death by apoptosis [9-11]. Bhutani KK *et al.* 2010 study shows that steroidal constituents from *Solanum xanthocarpum* and *Asparagus racemosus* clearly have the capacity to tumor cell death and these natural products represent interesting lead compounds for the development of potential cancer therapeutics. This is the first report on apoptosis inducing activity of immunoside, which was found to be the most active inducer of apoptosis amongst all the compounds tested in the study in HCT 116 human colon carcinoma cell line. Our data suggest that the presence of sugar moieties in *Solanum* compounds is associated with induction of necrotic cell death [12].

Antiasthmatic activity

A pilot study on the clinical efficacy of *Solanum xanthocarpum* and *Solanum trilobatum* in bronchial asthma were undertaken to prove the significant use of herbs in treatment of asthma [13]. Major literature data supports use of whole plants. Gautam *et al* 2008 evaluated the therapeutic effect of ethanolic extract of *Solanum xanthocarpum* i.e. asthma relieving or antihistaminic, antiallergic property.

Gautam *et al.* 2008 studied effects of *Solanum xanthocarpum* extract on some of the parameters like smooth muscle relaxation, and antagonism of asthma mediators such as histamine, eosinophils and protection against mast cell degranulation which seemed to be prominent in pathophysiology of asthma [14]. Further they showed that ethanol extract of *Solanum xanthocarpum* shown a significant

antihistaminic activity in histamine induced contraction in goat tracheal chain preparation. Thus, the significant inhibition of histamine induced contractions produced by ethanol extract of *Solanum xanthocarpum* flower on isolated goat tracheal chain preparation indicates that the *Solanum xanthocarpum* flower has antihistaminic (H₁- receptor antagonist) action. While screening the all three extracts of flowers of *Solanum xanthocarpum*, results were indicative that only ethanolic extract of *Solanum xanthocarpum* at a dose of 50 and 100 mg / kg reduced milkinduced eosinophilia of statistical significance. *Solanum xanthocarpum* at a dose of (50-100 mg/kg, i.p) showed significant mast cell stabilization as compared to standard drug Disodiumchromoglycate (DSCG).

Hypoglycemic activity

The aqueous extract showed significant hypoglycemic effect in both normal and streptozotocin induced diabetic rats at dose of 100 and 200 mg/kg. The activity showed by aqueous extract was comparable to that of standard oral hypoglycemic agent glibenclamide. The experimental results indicated that it exhibited a potent blood glucose lowering property both in normal and streptozotocin induced diabetic rats. The LD₅₀ of the extract was found to be high indicating high margin of safety [15].

Antifilarial activity

Lalit Mohan *et al.* reported the larvicidal potential of crude extracts of *Solanum xanthocarpum* and suggested its suitability as an ecofriendly, effective larvicide in the management of mosquito populations and in limiting the outbreak of various vector borne epidemics [16].

Mosquito larvicidal activity

The fruit extracts of *Solanum xanthocarpum* revealed larvicidal activity against *An. stephensi* and *Cx. Quinquefasciatus* and one culicine species *Ae. Aegypti*. Volatile oil obtained from *Solanum xanthocarpum* exhibited repellency against mosquito *Cx. quinquefasciatus* at a very lower concentration than those of the plants studied earlier. The lethal concentrations of fruit extract at LC₅₀ and LC₉₀ levels against *An. culicifacies*, *An. stephensi* and *Ae. aegypti* were determined as 0.112 and 0.258, 0.058 and 0.289 and 0.052 and 0.218% respectively. The root extract is also effective against anopheline and culicine mosquito species, though at higher concentrations in comparison to fruit extract [17].

Anti-inflammation activity

Stigmasterol, carpesterol and diosgenin showed Anti-inflammation Effect [18,19]. Lupeol in *Solanum xanthocarpum* also acted as multi-target agent with immense anti-inflammatory potential, targeting key molecular pathways, which involved nuclear factor kappa B (NFkB), cFLIP, Fas, Kras, phosphatidylinositol-3-kinase (P13)/Akt and Wnt/β-

catenin in a variety of cells. Lupeol at its effective therapeutic doses exhibited no toxicity to normal cells and tissues. Hence, it may serve as atherapeutic and chemopreventive agent for treatment of inflammation [20].

CONCLUSION

Solanum xanthocarpum is an important source of many pharmacologically and medicinally important chemicals, particularly steroidal hormone solasodine and other chemicals like solasonine, campesterol, campeferol, diosgenin and various useful alkaloids. *Solanum xanthocarpum* safe for human use and is regarded as a valuable plant in both Ayurvedic and modern drug development areas for its versatile medicinal uses. The plant is widely studied for the various pharmacological activities like antiasthmatic, hepatoprotective, cardiovascular, hypoglycemic and mosquito repellent properties. Most of the pharmacological studies were preliminary, carried out in animals and are not sufficient for the development of a pharmaceutical product. Further studies of other phytochemical compounds will possibly lead to exploration of new method for therapeutic and industrial application.

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